

NAVAL WAR COLLEGE
Newport, R.I.

Theater Missile Defense: Finding a Suitable Command and Control Structure

by

Steven W. Holmes
LCDR/U.S. Navy

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature: Steven W. Holmes

02 February 2000

COL L. Feero, USA
CAPT J. Edwards, JAGC, USN
Joint Military Operations Dept.

DISTRIBUTION STATEMENT A
Approved for Public Release
Distribution Unlimited

DTIC QUALITY INSPECTED 4

20000622 047

1. Report Security Classification: UNCLASSIFIED

2. Security Classification Authority:

3. Declassification/Downgrading Schedule:

4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR
PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.

5. Name of Performing Organization: JOINT MILITARY OPERATIONS DEPARTMENT

6. Office Symbol:

C

7. Address: NAVAL WAR COLLEGE
686 CUSHING ROAD
NEWPORT, RI 02841-12078. Title (Include Security Classification): Theater Missile Defense: Finding a Suitable
Command and Control Structure (U)

9. Personal Authors: LCDR Steven W. Holmes, USN

10. Type of Report: FINAL

11. Date of Report: 08 FEB 00

12. Page Count: 23

13. Supplementary Notation: A paper submitted to the Faculty of the NWC in partial
satisfaction of the requirements of the JMO Department. The contents of this paper
reflect my own personal views and are not necessarily endorsed by the NWC or the
Department of the Navy.14. Ten key words that relate to your paper:
Joint Theater Ballistic Missile Defense Command and Control15. Abstract: Current command and responsibilities guidance provided in Joint Pub 3-01.5 (Doctrine
for Joint Theater Missile Defense) assigns the operational elements of Joint Theater Missile Defense
to different commands and staffs. In order to provide the requisite unity of command and effort for
the mission and in light of the potential strategic impact of a successful attack, a more unified
command structure is needed. This can be met with the designation of a Joint Force Missile defense
Component Commander.16. Distribution /
Availability of
Abstract:

Unclassified

X

Same As Rpt

DTIC Users

17. Abstract Security Classification: UNCLASSIFIED

18. Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT

19. Telephone: 841-6461

20. Office Symbol: C

Abstract of

Theater Missile Defense: Finding a Suitable Command and Control Structure

Recent intelligence reports indicate that the threat from theater ballistic missiles (TBM) with various warhead configurations will continue to increase throughout the next fifteen years at least. Potential foes see this asymmetric weapon as one of the more effective means to counter and influence countries, such as the United States, that have significant military forces. Recognizing this threat, the United States embarked upon an aggressive anti-missile program and has put tremendous effort into developing anti-ballistic missile systems and their supporting C4I systems. These new systems will greatly improve theater missile defense capabilities.

Joint Pub 3-01.5 (Doctrine for Joint Theater Missile Defense) provides four operational elements to combat theater missiles: passive defense, active defense, attack operations, and Theater Missile Defense C4I. However, this doctrine appears to be written with emphasis on the element of attack operations and not the other elements--understandable given the assets available at the time of writing. Furthermore, the command and responsibilities guidance is disjointed and fails to provide adequate unity to effectively integrate all four elements of joint theater missile defense.

This paper examines the factors that should be considered when attempting to rectify the poor command structure guidance found in the doctrine, as well as some recommendations that have been forwarded. Given the time critical nature of this mission, the dispersal of supporting units, and the potential strategic implications of failure, a very streamlined and responsive command structure must be established. Depending on the threat and resources, this may be best accomplished through the designation of a Joint Force Missile Defense Component Commander.

Theater Missile Defense: Finding a Suitable Command and Control Structure

“After the attack on our barracks in Dharan, it is no longer possible to view ballistic missiles as an abstract, theoretical threat. American Blood has been shed. This threat is real and it is growing.”

--Sen. Robert C. Smith, 31 July 1991¹

Introduction

The U.S. National Intelligence Council delivered its “Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015” report to Congress at the beginning of September 1999 which asserts that the proliferation of medium-range ballistic missiles has created an immediate, serious, and growing threat to U.S. forces, interests, and allies.² It rates the probability that weapons of mass destruction (WMD) will be used against U.S. forces or interests as higher today than most of the Cold War and forecasts that countries will respond to U.S. missile defenses by deploying larger forces, penetration aids and countermeasures. “They need not be highly accurate; the ability to target a large urban area is sufficient. They need not be highly reliable, because their strategic value is derived primarily from the threat (implicit or explicit) of their use, not the near certain outcome of such use” the Intelligence Council analysts continued.³

To counter this growing asymmetric threat the United States embarked upon an aggressive technological anti-missile program fueled by a sense of urgency that was ignited by Saddam Hussain’s use of the Scud missile during the Gulf War. Although its roots can be traced back to President Reagan’s Strategic Defense Initiative of 1983, the Department of Defense established the Ballistic Missile Defense Organization (BMDO) in May 1993 due to the radically altered post-Cold War international security environment and signified a reorientation of ballistic

missile defense policy to place primary emphasis on developing and fielding advanced theater missile defenses.⁴

While the improved or entirely new active defense systems resulting from BMDO's efforts will form the cornerstone of this country's theater missile defenses, they will not be the end-all solution. As with any military system, the human interface is often more important than the hardware. Thus, only with an examination of the Joint Theater Missile Defense (JTMD) doctrine--the human guidance--can the new hardware and software be truly exploited. One of the most important elements of doctrine that must be carefully examined in light of the system improvements is command and control. As both theater missiles and theater missile defense systems mature, command and control of JTMD will have to adapt to the growth. This paper will seek to illuminate the major factors that should be considered and examine several potential approaches to forming a command and control structure. Additionally, because the emerging threat is primarily the theater ballistic missile, as opposed to cruise missiles or other air-to-surface missiles, much of the discussion will focus on the ballistic missile aspects of JTMD.

Operational Concepts of JTMD

Before the command and control structure can be evaluated in hopes of improvement, it is necessary to establish an understanding of what this structure will be responsible for and begin to identify where and how technological advances may impact current command and control (C2) principles.

The current authoritative guidance is contained in Joint Pub 3-01.5, Doctrine for Joint Theater Missile Defense. Joint Pub 3-01.5 defines joint theater missile defense as "the integration of joint force capabilities to destroy enemy theater missiles in flight or prior to launch or to otherwise disrupt the enemy's theater missile operations through an appropriate mix of

mutually supportive passive missile defenses, attack operations, and supporting command, control, communications, computers, and intelligence [C4I] measures.”⁵ It is in this definition that the four operational elements of JTMD are delineated: passive defense, active defense, attack operations, and TMD C4I.

The objective of passive defense is to provide essential individual and collective protection for friendly forces, population centers, and critical assets.⁶ Although the responsibility for passive defense execution is primarily at the unit level, the task of establishing theater event reporting systems that acquire, process and disseminate warning information to joint forces and population centers is assigned to the geographic combatant commander.⁷ This requirement illustrates the need for a robust C4I system that can fuse incoming data in a timely manner and provide a conduit to commands outside of the JTMD force structure, including foreign military units and civilian populations, as an avenue for providing the warning.

Active defense, on the other hand, is a defense in depth to protect selected assets and forces from attack by destroying TM [theater missile] airborne launch platforms and/or TMs in flight.⁸ Although improvements are being sought in all four elements of JTMD, active defense systems and their supporting C4I elements are receiving the most attention. The systems being developed will, for the first time, provide the capability to field a defense in depth that can conduct multiple intercept opportunities throughout the course of an inbound missile’s flight. Some of the challenges facing the command structure from the active defense mission include rules of engagement (ROE) recommendations, weapons control procedures and measures, asset management (including reloading), deployment and redeployment planning, recommendations to the Defended Assets List (DAL), and the integration of national, theater, and tactical sensors.

The objective of attack operations is to prevent the launch of TMs by attacking each element of the enemy's overall system and to deny or disrupt employment of additional missiles that may be available.⁹ Although Joint Pub states that attack operations are not a mission in itself,¹⁰ a considerable amount of effort and resources can easily be expended towards this cause. During DESERT STORM, CENTCOM's own statistics show that about 1,460 strikes were actually conducted (excluding those that did not find Scud targets) out of 41,310 bombing attacks.¹¹ Because the assets conducting the attack operations are not normally controlled by the commander responsible for TMD, the operational level concern is the detection, acquisition, and identification of targets for strikes as well as obtaining the befitting apportionment of attack resources based on the combatant commander's (CINC) or Joint Force Commander's (JFC) guidance. Effective attack operations also require real-time coordination between all component commanders and continuous wide-area surveillance over the entire theater/JOA.¹² This reiterates the need for a robust C4I system that can connect and integrate units from both within and external to the theater.

The final operational element of JTMD, C4I, is the system that links the other three elements together to provide timely assessment of the threat; rapid dissemination of tactical warning; and mission assignment, targeting data, and poststrike assessment to the appropriate JTMD element.¹³ Perhaps more importantly from the operational commander's point of view, it must provide rapid communications among intelligence assets, the fusion and decision-making facilities, warning systems, and weapon systems, to include a capacity for rapid coordination with supporting combatant commanders.¹⁴ Only then can the mission and command be efficiently executed.

Operational Factors and Functions

Aside from the mission concepts, there are several other key implications that should be examined before recommending changes to the TMD command structure. These factors can be illuminated through the examination of some of the operational factors and functions that an operational commander must consider.

Force (Enemy). It is estimated that by 2008, more than twenty countries will be able to field some form of TBM capability.¹⁵ These threats will be capable of various maximum ranges and will thus fly different profiles towards their targets while carrying a variety of payloads including conventional high explosives, chemical, biological, or nuclear warheads. As technology continues to proliferate it is safe to assume that the guidance and targeting accuracy of the missiles will improve as well. Not only will the TBMs continue to be a political-strategic threat, they will become a true operational and tactical threat. Because of its asymmetric nature, it is also a threat that will likely see increased use against countries with well developed military capabilities. In fact, a senior Indian defense analyst concluded that missile forces would be critical to thwarting the "offense designs" of great powers.¹⁶

Force (Own). Although efforts are being made to improve each of the JTMD operational elements, active defense and the supporting C4I systems will provide the most change in the field of TMD over the next decade. However, due to the varied threat, there will be no single "silver bullet" in theater missile defense.¹⁷ The Ballistic Missile Defense Organization is therefore developing the Family of Systems (FoS) concept--a flexible configuration of highly interoperable theater and air missile defense systems--which will allow the joint force commander to tailor the right mix of systems and capabilities according to the situation and threat.¹⁸ The four core programs being developed in the FoS are PATRIOT Advanced

Capability-3 (PAC-3), Navy Area TBMD, Theater High Altitude Area Defense (THAAD), and the Navy Theater Wide (NTW) systems.¹⁹ In addition, the U.S. Air Force is managing and executing the Airborne Laser (ABL), which will fill a critical void in the FoS.²⁰ The PAC-3 is a land-based, lower-tier system designed to achieve a hit-to-kill intercept of incoming missiles within the earth's atmosphere (endoatmospheric). Relative to the other systems, it has a small defended footprint--it is a fixed point defense system for stationary targets. THAAD is designed to complement the PAC-3 system by defending a larger footprint and intercepting missiles at higher altitudes (up to 100 km²¹), and is therefore an upper-tier system. THAAD is unique in the TBMD arena in that its missiles can consummate intercepts both outside and inside the atmosphere. However, the tradeoff for this endo- and exoatmospheric versatility is no capability against the TBM ascent phase.²² THAAD's range provides it sufficient battlespace, under most scenarios, to engage a threat, assess the success of the engagement, and, if necessary, fire a second missile.²³ Additionally, neither the PAC-3 nor THAAD systems are tactically mobile, they are transportable.

The Navy systems are both based on AEGIS cruisers and destroyers, and similar to the Army systems, one is a lower-tier system (Navy Area) while the other (NTW) is an upper-tier system. The Navy Area system will give the theater commander a defensive capability against short and medium range theater ballistic missiles in the atmosphere during their descent phase.²⁴ Like the PAC-3, the Standard Missile (SM-2) Block IVA will be multi-mission capable, lethal against cruise missiles and manned aircraft in addition to TBMs.²⁵ The Navy Area systems does, however, have a larger defended footprint and higher maximum intercept altitude than the PAC-3.²⁶ The Navy Theater Wide (NTW) system is an upper-tier defense that is only capable of

exoatmospheric intercepts using the SM-3 missile. Although limited to exoatmospheric engagements, NTW is the only system capable of ascent phase intercepts.²⁷

Under ideal circumstances, there will be four layers of protection, with NTW positioned for ascent-phase and long-range midcourse intercepts, THAAD covering the upper-tier exoatmospheric and very-high-altitude endoatmospheric threats, Navy area defense providing robust capability below 35 km, and fast, agile PAC-3 destroying leakers in the endgame.²⁸ Realization of the ABL will fill the one remaining gap that none of the land- or sea-based systems can manage--the boost phase intercept (BPI). But rarely will these ideal circumstances present themselves. The political, geographic, and force structure restrictions are too varied to assume this ideal situation. For example, land-based systems may not be allowed to be positioned in theater when and where they should; the simple geometry of the threat area may not allow a layered defense; the availability, the need for defenses in other locations, and the competition with other cruiser and destroyer missions may preclude an all-encompassing TBM defense. Logistics and sustainment will also play an important factor in TBMD for both the land- and sea-based missile defense systems.

The naval systems in particular present the commander responsible for air and missile defense with new challenges. Prior to deployment from the United States (or overseas homeport), the loadout of the ship's vertical launching system (VLS) must be decided upon. Eight weapons for different missions will be competing for this finite VLS space.²⁹ Additionally, the VLS has a very nominal underway replenishment capability, and in fact the SM-2 Block IV (and the Tomahawk) cannot be transferred at sea at all due to weight limitations of the VLS handling crane.³⁰ Furthermore, these ships will need to be refueled and resupplied--an activity not normally conducted in a threatening area. And unlike the PATRIOT and THAAD systems,

the naval TMD systems are carried on multi-mission vessels that may be needed elsewhere for other tasking, or in positions that would likely move them out of an effective TMD position. In fact, the location for missile defense may make the vessel or other vessels more vulnerable to attack from enemy air, sea or undersea weapon systems.

Space. The commander's concern of space as an operational factor goes beyond the increasing ranges of threat missiles. Along with these increased ranges come more high value locations that may need protection--which further stresses the availability of TMD assets. The effect on lower-tier active defense systems from the longer range, and thus higher terminal velocity, missiles is a decrease in the area that can be defended.³¹ A defense in depth approach, with overlapping engagement "space," will require weapon control measures to ensure that not every unit which has engagement quality data will fire its interceptors.

There is another effect from the ballistic missile threat that will become increasingly troubling for commanders. As these missiles are employed to shape the fight in a manner that is useful to the enemy, the boundaries between battles, campaigns, and theaters will become less and less definable.³² One of the difficulties in the Gulf War was the fact that Israel, threatened only by ballistic missiles from Iraq, fell outside the CENTCOM area of responsibility. There were no established relationships between CENTCOM and Israel, and as a result the command had little appreciation for Israel's concerns and no real contacts in the Israeli military.³³ For good reasons, the military prefers clearly defined boundaries, but now geographic boundaries and major command structures can quite easily be crossed. To treat these relatively arbitrary dividing lines as impermeable would cause yet another level (or levels) of staffing/decision-making in the midst of a very time-critical mission as well as an increase in required defensive assets.

Time. The operational factor of time, like space, is an advantage for the enemy. Only in the area of JTMD attack operations does time tend to favor the U.S. and its allies because attack operations can be more efficient by destroying a significant portion of an enemy's capability prior to its use. These attacks must occur at the outset of the conflict, however, because counterforce strategies do face diminishing returns as a war progresses.³⁴ Once a ballistic missile attack is launched, time is most certainly on the attacker's side--the evolution is measured in minutes. In this time, detection, acquisition, warning, targeting, and firing must all be accomplished. The combatant who has sufficient information and agility to consistently operate inside his opponents OODA loop, deciding and acting faster, is likely to prevail.³⁵ It must be remembered that in a matter of minutes, a single weapon can have simultaneous tactical, operational, and strategic effects.

It should also be remembered that although the family of active defense systems being developed will provide a robust defense in depth, they will not be operational at the same time. Pending any further budgetary or technological delays, the four core TBMD systems will be incrementally fielded spanning approximately ten years with at least two years between each program.³⁶ This will drive a corresponding incremental development of strategy and doctrine as the intricacies of each system is discovered under operational conditions.

Finally, at both the operational and strategic levels of war, successful ballistic missile attacks can have a profound effect on the will to continue the fight and thus could have an enormous impact on the duration of the conflict.

Operational C2. There are two points that need to be examined concerning TMD command and control aside from the normal ideals of C2 such as centralized control with decentralized execution, the tendency towards functional architectures vice service oriented ones,

and “flattened” chains of command among others. Both of these points were presented in Commander Swicker’s work concerning naval TBMD,³⁷ but are applicable to TBMD as a whole. The first point is that centralized, high-level “meddling” is both inevitable and understandable given the uniquely political nature of ballistic missiles. Secondly, and somewhat related, is the notion that military forces possessing unique capabilities related to political centers of gravity tend to see their command and central architectures “stovepipe” toward centralized control of the NCA.

The first point appears to be a specific application of an often voiced concern of Network Centric Warfare (NCW) to TBMD. Not only does linking sensors, shooters, and C2 capabilities improve battlespace awareness, it has the potential to contribute to the coalescence of the tactical, operational, and strategic levels of war through quick and effective observation and communication capabilities.³⁸ As a result, there may be the tendency for echelons of command that do not need to be actively involved to “meddle.” However, this is a human behavior problem and should not be used to justify the breaking apart of the network at the cost of effectiveness and efficiency. The consequence of Swicker’s second point, command gravitating towards the NCA due to the political nature of the threat, may bring dramatic slowing of TMD operations due to the extra layers of supporting commands and staffs between the command authority and the tactical units. Another unintended consequence would be the “cascading versions of *processed* information” (emphasis original).³⁹ Given the time constraints of missile defense, delays and iterative processing of information is unacceptable and must be avoided at all cost.

The overall impact of the preceding requirements and considerations on command structure is that the high level of required integration among and between the elements of JTMD,

the critical nature of time, and the potential effects of a successful theater missile attack demand that the commander responsible for TMD be carefully selected to provide responsiveness unencumbered by unnecessary layers of command as well as the necessary control to effectively and efficiently complete the mission.

Command Relationships

Joint Pub 3-01.5 establishes the overall responsibility for air defense to an Area Air Defense Commander (AADC) and further states that "The successful conduct of theater air defense requires the **integrated operation of all available air defense weapon systems** of all components." (emphasis original)⁴⁰ Closer examination, however, reveals that not all of the operational elements are under the direction of the AADC so that they can be effectively integrated. Planning and execution of attack operations outside other component commander area of operations are relegated to the Joint Force Air Component Commander,⁴¹ the Joint Force Staff (J-6) is responsible for the C4 system, and the component commanders have operational control of their active defense forces.⁴² This division of labor may be an attempt to provide unity of effort instead of unity of command, but in the end it appears to be relatively unclear and somewhat contradictory. On the one hand the doctrine stresses integration, but it then separates the elements of JTMD. Joint Pub 3-01.5 then goes on to state that due to the need to maintain theater/JOA-wide visibility on JTMD attack operations and the integrated relationship between the other operational elements of JTMD, the Joint Force Commander (JFC) may assign the responsibilities of the AADC to the JFACC.⁴³ At what point does the workload cause one or both primary missions to be neglected? How much effort will really be placed on this additional mission? The need for unambiguous command relationships and centralized control was demonstrated in Exercise ROVING SANDS 96 when the AADC directed the redeployment of a

Patriot battery to cover a sector that an AEGIS could no longer protect. But because the Patriot battery was TACON to the Sector Air Defense Coordinator (SADC) and the redeployment order did not originate from the SADC, the battery remained where it was and left the newly assigned sector undefended.⁴⁴

While the current doctrine may be due to the fixed-point, predominantly single service active defense systems that were not able to provide defense in depth and the dominance of attack operations, in the very near future the active defense systems will provide the bulk of the TMD protection. This change in capability, coupled with the potential strategic implications of a successful TBM attack, warrant a much more unified command structure. Recognizing the shortcomings of the current doctrine and the upcoming system improvements, there have been several recommendations for JTMD command relationships/structures at the operational level.

One such recommendation is to have USSPACECOM serve as the foundation for a joint operational proponent for JTMD.⁴⁵ This proponent would be staffed to support regional CINCs during two regional contingencies. Although these staffs would not be designated the commander per se, they would form a core to provide integration and oversight without being biased by service connection. It would also serve as a center for JTMD affairs continuously, not just in times of war or conflict.

USEUCOM, during NTF Wargame 95B, added a Theater Missile Defense Advisor (TMDA) above the AADC and which later resulted into the addition of a CINC staff TMD Cell.⁴⁶ Although this arrangement certainly adds emphasis to the TMD mission, it adds more command layers which delays action and increases the chance for errors. It was, in large part, a response-of-necessity by a CINC who felt that "The lack of an effective theater missile defense is a potential war-stopper for this theater."⁴⁷

Within the functional commander architecture, there have also been several recommendations. First, it has been recommended that there be a Deputy to the JFACC designated to be responsible for JTMD as well as serving as the AADC and the Airspace Control Authority (ACA).⁴⁸ The clear advantage would be the relationship with the JFACC for coordinating attack operations; however, task-saturation for such a multi-function commander would have to be carefully considered. Next, the USCENTCOM ROVING SANDS 95 lessons learned recommend creating a Theater Air Defense Commander (TADC) who works for the AADC, and whose main job is to arbitrate the gray areas between Service TBMD control centers with overlapping footprints.⁴⁹ While this may enhance the AADC's effectiveness, it also adds another link in the chain of command and therefore fails to provide unification. Finally, it has been recommended that a separate Joint Force Missile Defense Commander (JFMDC), or Theater Missile Defense Component Commander (TMDCC), be created with equal seniority as the JFACC, JFLCC, and the JFMCC.⁵⁰ Although the title is not important, the concept is. This organization would provide the unity of command and mission emphasis lacking in other relationships as well as the status to effectively influence the JFACC for attack operations.

Given the fact that theater missiles can have significant political as well as military impact, it is even conceivable that the CINC or JFC may feel impelled to hold command of the TMD function entirely within his/her organization. Forces possessing unique capabilities related to political centers of gravity tend to see their C2 architectures stovepipe toward centralized control of the NCA.⁵¹ As the new or improved active defense systems become operational but not widespread, they will almost certainly be treated as an extremely high value asset and will be controlled accordingly.

Conclusions/Recommendations

Which of the above command structures is the right answer? Unfortunately, they may all be the right answer because each situation has its own unique requirements and all have advantages and disadvantages. To determine which structure is best suited for a particular scenario, a CINC should keep the following in mind:

- The threat of theater ballistic missile attacks will garner strategic-level attention, and possibly direct involvement.
- The fact that missile attacks are carried out in a matter of minutes requires a command structure that is streamlined and responsive.
- Effective integration of the four operational elements of JTMD demands a robust, network-centric style C4I system. This will require sufficient allocation of space assets to provide the required connectivity and the discipline of upper level commands to not “meddle” in the problem.
- Shifting or phasing of the JTMD command structure may be required as asset availability changes in theater.
- Geographic boundaries can easily be breached by theater ballistic missiles; formal relationships and agreements may need to be established to provide for this contingency.
- Proliferation of the missile threat will most likely demand that a TMD Cell be established on every CINC staff. The potential for loyalty to the commander and not the mission or supporting units may dictate that this cell not be included in any formal chain of command.

- Although the active defense and C4I components are being developed as a family of systems, the probability that these assets will be available at the same time and in the desired amount is unlikely; intelligent and experienced planners will be needed to reduce the vulnerability.
- JTMD demands the highest levels of jointness and integration which is best served through a functional command structure.

In summary, a CINC must carefully assess the range and depth of the theater missile threat and tailor the command structure to meet the threat. In circumstances with a considerable threat and the likelihood of armed conflict, however, a separate Joint Force Missile Defense Component Commander that has adequate authority and resources may provide the best balance between centralized control and unity of effort. Otherwise, a small but well-trained staff, dedicated to the TMD mission, at the CINC level, may prove to be the best suited to provide the focus and continuity required.

Endnotes

- ¹ Scott K. McMahon, Pursuit of the Shield: The U.S. Quest for Limited Ballistic Missile Defense, (Lanham, Maryland: University Press of America, Inc., 1997), 101.
- ² "National Intelligence Community Assesses Missile Threat," 13 September 1999, Lkd. Air Defense Artillery Magazine Online <<http://147.71.210.21/adamag/wmd.htm>> (19 November 1999), 1.
- ³ *Ibid*, 1.
- ⁴ U.S. Department of Defense, Ballistic Missile Defense Organization, "BMDO Fact Sheet SR-99-01: History of the Ballistic Missile Defense Organization," April 1999, Lkd. Fact Sheets at "Ballistic Missile Defense Organization Page," <<http://www.acq.osd.mil/bmdo/bmdolink/pdf/sr9901.pdf>> (14 January 2000), 1.
- ⁵ U.S. Joint Chiefs of Staff, Doctrine for Joint Theater Missile Defense (Joint Pub 3-01.5) (Washington: 22 February 1996), I-3.
- ⁶ See Joint Pub 3-01.5, Chapter III, Section C for complete discussion on passive defense.
- ⁷ *Ibid*, III-4.
- ⁸ See Joint Pub 3-01.5 Chapter III, Section D for complete discussion on active defense.
- ⁹ See Joint Pub 3-01.5 Chapter III, Section E for complete discussion on active defense.
- ¹⁰ *Ibid*, III-11.
- ¹¹ Michael R. Gordon and Bernard E. Trainor, The General's War: The Inside Story of the Conflict in the Gulf (New York: Back Bay Books, 1994), 238.
- ¹² Joint Pub 3-01.5, III-11.
- ¹³ See Joint Pub 3-01.5 Chapter III, Section F for complete discussion on C4I.
- ¹⁴ *Ibid*, III-14.
- ¹⁵ Charles C. Swicker, Theater Ballistic Missile Defense from the Sea: Issues for the Maritime Component Commander, The Newport Papers, ed. Patricia A. Goodrich, no. 14 (Newport, RI: U.S. Naval War College, 1998), 7.
- ¹⁶ McMahon, 77-78.
- ¹⁷ Lester L. Lyles, "Statement of Lieutenant General Lester L. Lyles, USAF, Director, Ballistic Missile Defense Organization before the Senate Appropriations Committee Subcommittee on Defense," 14 April 1999, Lkd. Ballistic Missile Defense Statements at "BMDOLINK File Library Page," <<http://www.acq.osd.mil/bmdo/bmdolink/html/lyle14apr99.html>> (14 January 2000), 4.
- ¹⁸ U.S. Department of Defense, Ballistic Missile Defense Organization, "BMDO Fact Sheet AQ-99-16: The Family of Systems Concept," March 1999, Lkd. Fact Sheets at "Ballistic Missile Defense Organization Page," <<http://www.acq.osd.mil/bmdo/bmdolink/pdf/aq9916.pdf>> (14 January 2000), 1.
- ¹⁹ U.S. Department of Defense, Ballistic Missile Defense Organization, "BMDO Fact Sheet AQ-99-01: Ballistic Missile Defense - The Core Programs," February 1999, Lkd. Fact Sheets at "Ballistic Missile Defense Organization Page," <<http://www.acq.osd.mil/bmdo/bmdolink/pdf/aq9901.pdf>> (14 January 2000), 1.
- ²⁰ Lyles, 4.
- ²¹ Dennis Steele, "ADA - A View of the Future," Army, December 1999, 20.
- ²² Swicker, 67.
- ²³ U.S. Department of Defense, Ballistic Missile Defense Organization, "BMDO Fact Sheet AQ-99-01: Ballistic Missile Defense - The Core Programs," 2.
- ²⁴ *Ibid*, 1.
- ²⁵ Swicker, 22.
- ²⁶ *Ibid*, 23.
- ²⁷ *Ibid*, 24.
- ²⁸ *Ibid*, 68.
- ²⁹ *Ibid*, 35.
- ³⁰ *Ibid*, 34.
- ³¹ *Ibid*, 23.
- ³² Daniel Gouré and Christopher M. Szara, eds, Significant Issues Series: Vol XIX, No. 4, Air and Space Power in the New Millennium, With an introduction by Gen. Ronald R. Fogleman, USAF, (Washington: Center for Strategic and International Studies, 1997), 109.

-
- ³³ Gordan and Trainor, 235.
- ³⁴ James J. Wirtz, "Counterforce and Theater Missile Defense: Can the Army use an ASW Approach to the SCUD Hunt?" 27 March 1995, Joint Electronic Library CD-ROM, (Washington: Joint Chiefs of Staff, February 1999), 10.
- ³⁵ Swicker, 13.
- ³⁶ U.S. Department of Defense, Ballistic Missile Defense Organization, "BMDO Fact Sheet AQ-99-16: The Family of Systems Concept," 2.
- ³⁷ Swicker, 38-39.
- ³⁸ David S. Alberts and others, Network Centric Warfare: Developing and Leveraging Information Superiority, 2nd ed. (CCRP Publication Series, 1999), 88.
- ³⁹ Richard D. Hooker, "Joint Campaigning in 2010," Joint Force Quarterly, Autumn/Winter 1998-99, 44.
- ⁴⁰ Joint Pub 3-01.5, II-5.
- ⁴¹ Ibid, II-6.
- ⁴² Ibid, III-9.
- ⁴³ Ibid, II-6.
- ⁴⁴ William L. Spacy II, "Command and Control of Theater Missile Defense: Joint Doctrinal Imperative," (Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1997), 8-9.
- ⁴⁵ Howard I. Harmatz, "Joint Theater Missile Defense," (Unpublished Research Project, U.S. Army War College, Carlisle, PA: 1996), 22.
- ⁴⁶ Swicker, 72-73.
- ⁴⁷ Swicker, 73. Taken from "USEUCOM Concept for Theater Missile Defense Operations."
- ⁴⁸ Steven C. Schlientz, "Improving Theater Ballistic Missile Defense at the Operational Level of War," (Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1996), 16.
- ⁴⁹ Swicker, 73.
- ⁵⁰ Spacy, 8; Schlientz, 16.
- ⁵¹ Swicker, 39.

SELECTED BIBLIOGRAPHY

- Alberts, David S., John J. Garstka, and Frederick P. Stein. Network Centric Warfare: Developing and Leveraging Information Superiority. 2nd ed. CCRP Publication Series, 1999.
- "Army Air & Missile Defense Master Plan: The Threat, Evolution and Future Trends." Air Defense Artillery, April-May-June 1997, 18-26.
- Blazar, Ernest. "The Missile Killers: Navy Programs Key to Fielding TBMD, NMD Systems." Sea Power, September 1999, 39-41.
- Case, Blair. "Sea-Base National Missile Defense: DoD Reports on Navy Theater Wide Interceptor's Role in National Missile Defense." Lkd. Air Defense Artillery Magazine. <<http://147.71.210.21/adamag/report.htm>> (19 November 1999).
- Cole, Ronald, Walter Poole, James Schnabel, Robert Watson, and William Webb. The History of the Unified Command Plan 1946-1993. February 1995. Joint Electronic Library CD-ROM. Washington: U.S. Joint Chiefs of Staff, February 1999.
- Duffy, Thomas. "Comptroller May Shift Lower-Tier Missile Defense to Services." Inside The Navy. 22 November 1999. <<http://ebird.dtic.mil/Nov1999/s19991122comptroller.htm>> (24 November 1999).
- Erwin, Sandra I. "U.S. Ponders Sea-Based Missile Defense." National Defense, October 1999, 25-26.
- Gordon, Michael R. and Bernard E. Trainor. The General's War: The Inside Story of the Conflict in the Gulf. New York: Back Bay Books, 1994.
- Gouré, Daniel and Christopher M. Szara, eds. Significant Issues Series: Vol XIX, No. 4, Air and Space Power in the New Millennium. With an introduction by Gen. Ronald R. Fogleman, USAF. Washington: Center for Strategic and International Studies, 1997.
- Harmatz, Howard I. "Joint Theater Missile Defense." Unpublished Research Project, U.S. Army War College, Carlisle, PA: 1996.
- Holzer, Robert. "Pentagon Slashes Navy Missile Defense Program: Officials Shift Funds to U.S. Army's THAAD Project." Defense News. 29 November 1999. <<http://ebird.dtic.mil/Nov1999/s19991123slashes.htm>> (24 November 1999).
- Hooker, Richard D. "Joint Campaigning in 2010." Joint Force Quarterly, Autumn/Winter 1998-99, 40-47.

Kelly, Ricky B. "Centralized Control of Space: The Use of Space Forces by a Joint Force Commander." 22 September 1994, Joint Electronic Library CD-ROM. Washington, DC: Joint Chiefs of Staff, February 1999.

Lyles, Lester L. "Statement of Lieutenant General Lester L. Lyles, USAF, Director, Ballistic Missile Defense Organization before the Senate Appropriations Committee, Subcommittee on Defense." 14 April 1999. Lkd. Ballistic Missile Defense Statements at "BMDOLINK File Library Page." <<http://www.acq.osd.mil/bmdo/bmdolink/html/lyle14apr99.html>> (14 January 2000).

Macgregor, Douglas A. "Command and Control for Joint Strategic Actions." Joint Force Quarterly, Autumn/Winter 1998-99, 25-33.

McMahon, Scott K. Pursuit of the Shield: The U.S. Quest for Limited Ballistic Missile Defense. Lanham, Maryland: University Press of America, Inc., 1997.

"National Intelligence Community Assesses Missile Threat." 13 September 1999. Lkd. Air Defense Artillery Magazine. <<http://147.71.210.21/adamag/wmd.htm>> (19 November 1999).

Newman, Richard J. "The New Space Race." U.S. News and World Report, 08 November 1999, 30-38.

Schlientz, Steven C. "Improving Theater Ballistic Missile Defense at the Operational Level of War." Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1996.

Spacy, William L., II "Command and Control of Theater Missile Defense: Joint Doctrinal Imperative." Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1997.

Steele, Dennis. "ADA - A View of the Future." Army, December 1999, 17-22.

Steindl, David F. "Maximizing Operational Protection in the Face of the Theater Ballistic Missile Threat: 1996-2006." Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1996.

Swicker, Charles C. Theater Ballistic Missile Defense from the Sea: Issues for the Maritime Component Commander. The Newport Papers, ed. Patricia A. Goodrich, No. 14. Newport, RI: U.S. Naval War College, 1998.

U.S. Department of Defense. Ballistic Missile Defense Organization. 1997 Report to the Congress on Ballistic Missile Defense. Washington: U.S. Department of Defense, Ballistic Missile Defense Organization, 01 October 1997.

_____. Ballistic Missile Defense Organization. "BMDO Fact Sheet AQ-99-01: Ballistic Missile Defense - The Core Programs." February 1999. Lkd. Fact Sheets at "Ballistic

Missile Defense Organization Page.”

<<http://www.acq.osd.mil/bmdo/bmdolink/pdf/aq9901.pdf>> (14 January 2000).

. Ballistic Missile Defense Organization. “BMDO Fact Sheet AQ-99-13: Joint Composite Tracking Network.” January 1999. Lkd. Fact Sheets at “Ballistic Missile Defense Organization Page.” <<http://www.acq.osd.mil/bmdo/bmdolink/pdf/aq9913.pdf>> (14 January 2000).

. Ballistic Missile Defense Organization. “BMDO Fact Sheet AQ-99-16: The Family of Systems Concept.” March 1999. Lkd. Fact Sheets at “Ballistic Missile Defense Organization Page.” <<http://www.acq.osd.mil/bmdo/bmdolink/pdf/aq9916.pdf>> (14 January 2000).

. Ballistic Missile Defense Organization. “BMDO Fact Sheet PO-00-01: The Ballistic Missile Defense Fiscal Year 2000 Budget.” November 1999. Lkd. Fact Sheets at “Ballistic Missile Defense Organization Page.” <<http://www.acq.osd.mil/bmdo/bmdolink/pdf/po9901.pdf>> (14 January 2000).

. Ballistic Missile Defense Organization. “BMDO Fact Sheet SR-99-01: History of the Ballistic Missile Defense Organization.” April 1999. Lkd. Fact Sheets at “Ballistic Missile Defense Organization Page.” <<http://www.acq.osd.mil/bmdo/bmdolink/pdf/sr9901.pdf>> (14 January 2000).

. Ballistic Missile Defense Organization. “CINCs Theater Missile Defense Assessment Program.” Lkd. Joint Theater Missile Defense Program Efforts at “Theater Missile Defense Programs Page.” <<http://www.acq.osd.mil/bmdo/bmdolink/html/cinc.html>> (14 January 2000).

. U.S. Army. Joint Tactical Ground Station Operations. (FM 40-1). 01 September 1999. Lkd. Army Digital Training Library at “U.S. Army Homepage.” <<http://www.adtdl.army.mil/cgi-bin/atdl.dll/fm/40-1/toc.htm>> (19 November 1999).

. U.S. Space Command. Long Range Plan: Executive Summary.

U.S. Joint Chiefs of Staff. Command and Control for Joint Air Operations (Joint Pub 3-56.1). 14 November 1994. Joint Electronic Library CD-ROM. Washington: U.S. Joint Chiefs of Staff, February 1999.

. Department of Defense Dictionary of Military and Associated Terms (Joint Pub 1-02). 23 March 1994, as Amended Through 7 December 1998. Joint Electronic Library CD-ROM. Washington: U.S. Joint Chiefs of Staff, February 1999.

. Doctrine for Joint Airspace Control in the Combat Zone (Joint Pub 3-52). 22 July 1995. Joint Electronic Library CD-ROM. Washington: U.S. Joint Chiefs of Staff, February 1999.

_____. Doctrine for Joint Theater Missile Defense (Joint Pub 3-01.5) Washington: 22 February 1996.

_____. Doctrine for Command, Control, Communications, and Computer (C4) Systems Support to Joint Operations (Joint Pub 6-0) Washington: 30 May 1995.

_____. Joint Vision 2010. Joint Electronic Library CD-ROM. Washington: U.S. Joint Chiefs of Staff, February 1999.

Utecht, Richard J. "National Missile Defense: A New Mission for the Total Force." Unpublished Research Project, U.S. Army War College, Carlisle, PA: 1996.

Wirtz, James J. "Counterforce and Theater Missile Defense: Can the Army use an ASW Approach to the SCUD Hunt?" 27 March 1995. Joint Electronic Library CD-ROM. Washington, DC: Joint Chiefs of Staff, February 1999.

Zappalla, Steve. "Joint Theater Missile Defense: An Army Assessment." Unpublished Thesis, U.S. Army Command and General Staff College, Ft. Leavenworth, KS: 1993.